

NOAA'S National Weather Service



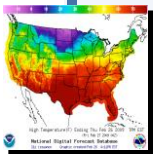
Advanced Concepts of *Severe Storm Spotting*

2011 – Rusty Kapela
Milwaukee/Sullivan
Weather.gov/milwaukee

Doug Ratlik
East of Madison
Dane County
June 23, 2004

Problems Spotters Encounter

- Spotters can only see a limited area, and much of the time the spotter view is being blocked by rain/hail, hills, trees, and buildings.
- Spotters have a hard time getting the “big picture” of what is going on around them.
- Mobile spotters may not have access to radar data to find where to go.
- Spotters have a hard time judging distances to weather phenomena...underestimate...so don't do this...besides, we don't need this information!



➤ **Every storm is different – the classic text-book images, graphics, and video clips you see in this presentation will most likely not be seen all the time in the real world.**

- *Many spotters have said “things always look different in the field.”*
- **If the storms are moving rapidly you will not have much time to recognize the important features and “put it all together”**
 - *this is when you are likely to make a mistake!*



The Big Picture

- Spotters should self-educate themselves with on-line educational material, courses, Top News of the Day stories, SkyWarn pages, etc.
- The NWS Southern Region Office has an on-line School for Weather entitled “JetStream”

National Weather Service
JetStream - Online School for Weather

Go to: Topic Matrix NWS Home Weather forecast by "City, St" or zip code: City, St

Jetstream Topics

1. Why JetStream?
2. The Atmosphere
3. The Ocean
4. Global Weather
5. Synoptic Meteorology
6. Thunderstorms
7. Lightning
8. Tropical Weather
9. Doppler Radar
10. Remote Sensing
11. Weather on the Web
12. The National Weather Service
13. Appendix

Additional Info:
Lesson Plan Overview
Topic Matrix
JetStream News

Nova Scotia and the Bay of Fundy are featured in this image, acquired January 23, 2010 by the MODIS on the Aqua satellite. Nova Scotia, a Canadian province, is the long peninsula that runs diagonally across the image. Snow covers the ground.

The Bay of Fundy is on the western side of the island. Note the reddish coloration near the northern coastline of the Bay. In this image, much of the red coloring is in the sub-bays - Chignecto Bay is the one to the north. Minas Basin and its eastern portion, the Cobequid Bay, make up the more southern inlet of the two you see here.

The color of the water is due to sediment caused by tides. The Bay of Fundy has the highest tides in the world - the water can rise and fall as much as 50 feet each day! During each tidal cycle, huge quantities of fine sediments are brought in to flood the coastal area. Much of the sediment remains in the sheltered areas along the coast, forming the famous red mudflats of the upper Bay. [Learn more about the Bay of Fundy.](#)

Credit: Jeff Schmaltz, [MODIS](#) Land Rapid Response Team, NASA GSFC [Click to enlarge.](#)

<http://www.srh.weather.gov/jetstream/index.htm>



Thunderstorm Development

National Weather Service



Iowa State
University
MesoNet

Video is time
lapse fast
forward



Types of Thunderstorms

Single
Cell

Multicell
Cluster

Multicell
Line

Supercell

Weak updraft
(non-severe
or severe)

Moderate
updraft (non-
severe
or severe)

Moderate
updraft (non-
severe
or severe)

Intense updraft
(Always severe)

**Mesocyclone -
Rotating updraft**

Slight threat

*Moderate
threat*

*Moderate
threat*

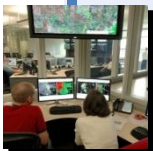
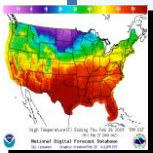
High threat



Single Cell Storms



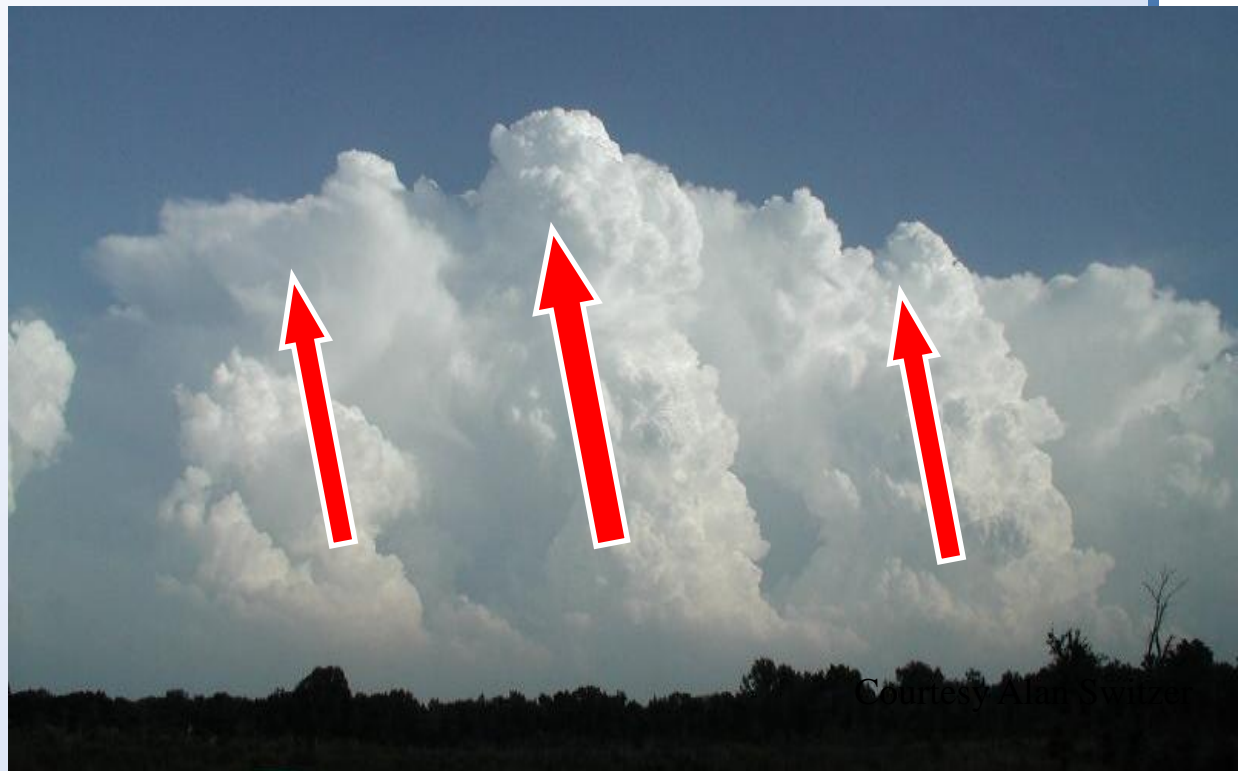
May produce brief severe events



Multi-cell T'storm Clusters

Ordinary non-organized storms with low severe threat

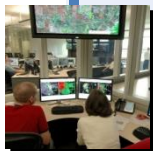
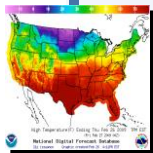
Each cell lasts
20-30 minutes,
but a cluster
can last for
hours



Courtesy Alan Switzer

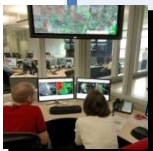
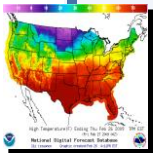
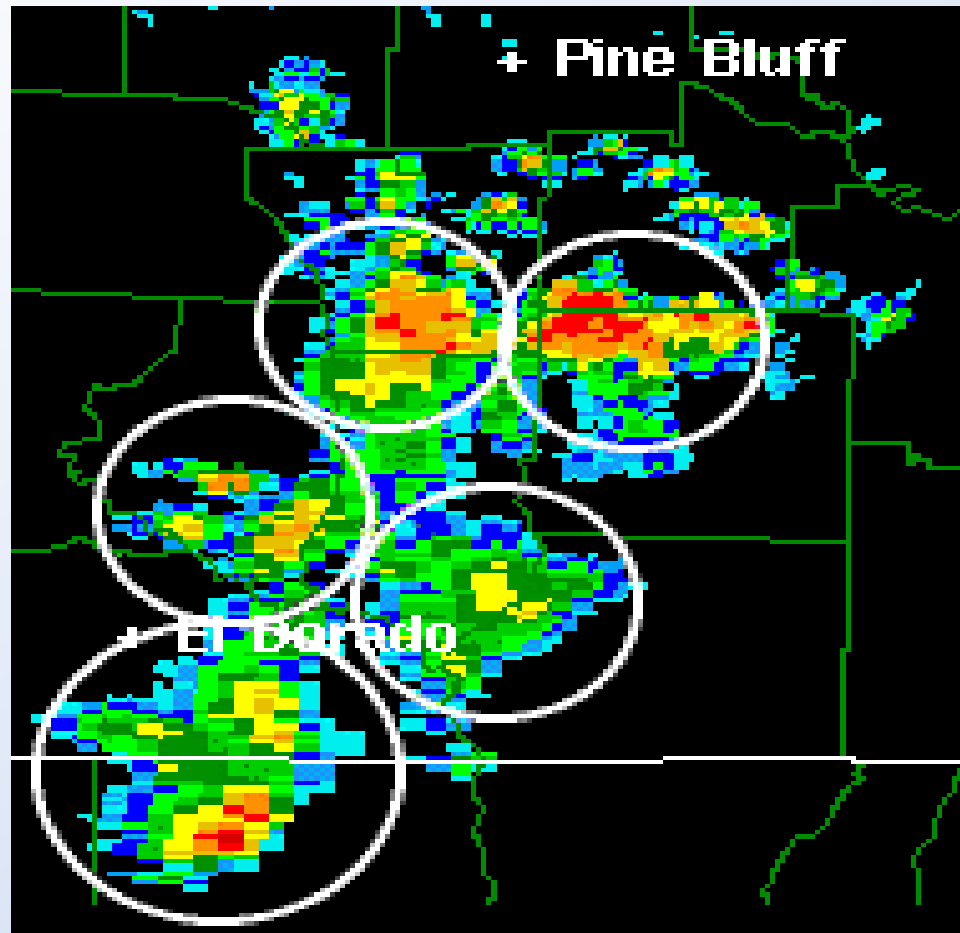
Heavy rain is the main problem

However, strong winds, small hail
and weak tornadoes are possible



Multi-cell Thunderstorms

Ordinary non-organized storms with low severe threat



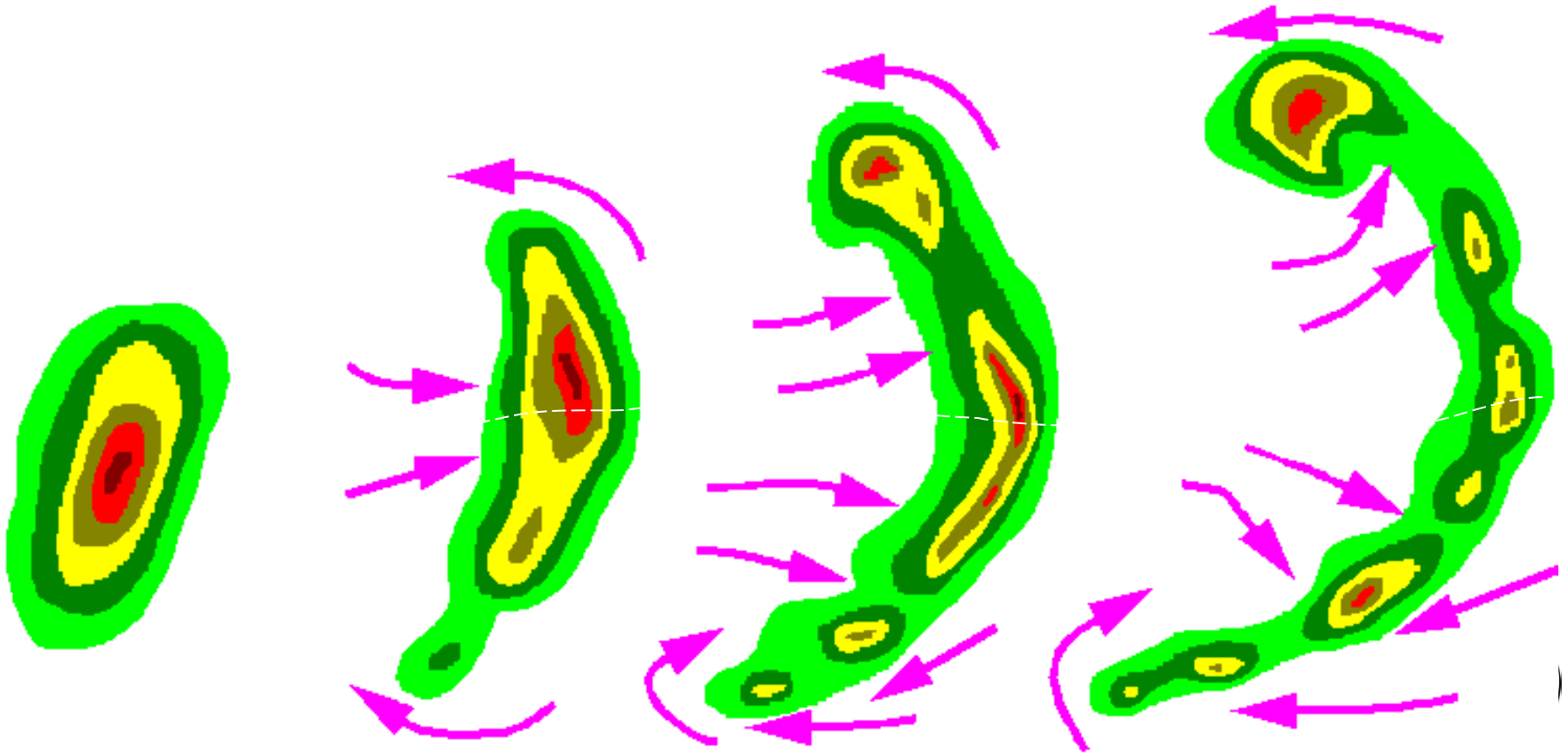
Multi-cell (Squall) Line



- Leading edge of Squall Line usually marked by shelf cloud. Do not report shelf clouds.
- What to expect
Strong and possibly damaging wind
Heavy rain/hail

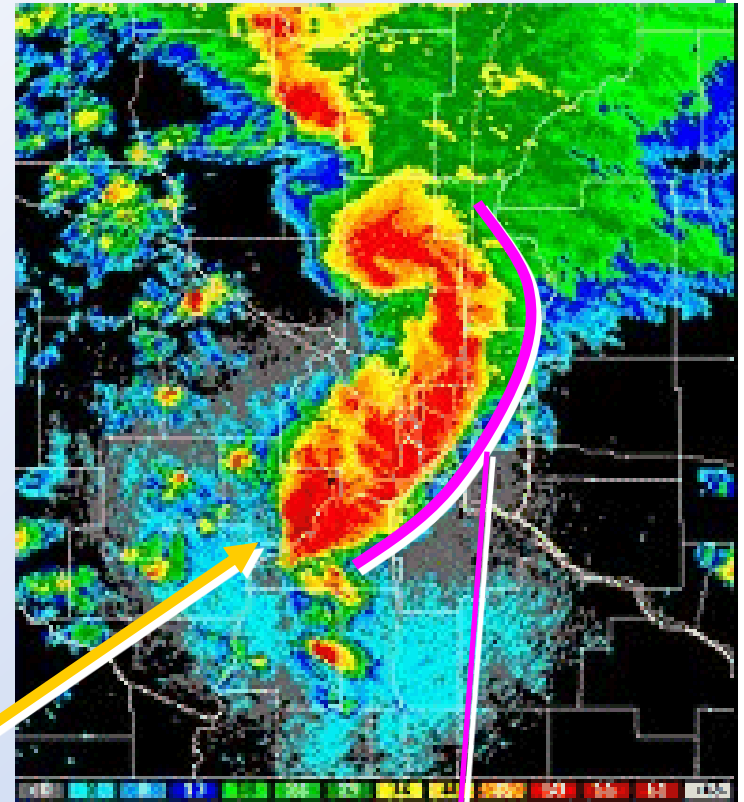


Multi-cell Line (Bow Echo)



Squall Line - Bow Echo

This shelf cloud is ahead of bow echo on right!

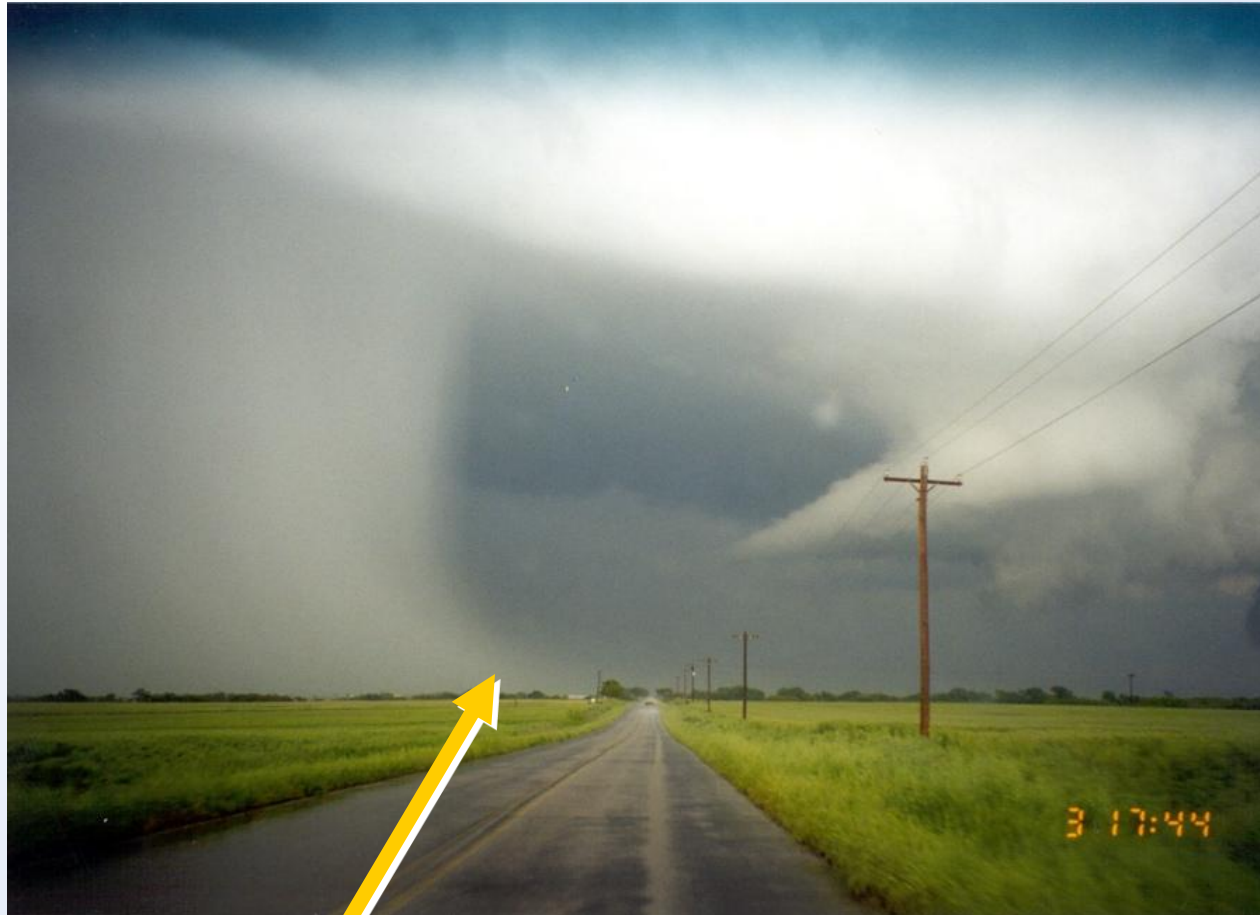


Storm moving left to right (W-E)

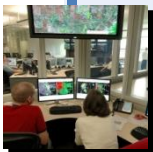
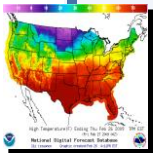
Well-developed shelf cloud is found on front side of line



Rain Foot



Rain Foot = Strong downburst winds



National Weather Service
Protecting Lives and Property



Supercell

Main Features

Rear Flank
Downdraft

Forward Flank
Downdraft

Rain Free Base

Wall Cloud



“Classic” Tornado

ice
erty



Near Central City, IA, Apr 26, 2009



Wedge Tornado

©2010 - Shannon Lupton



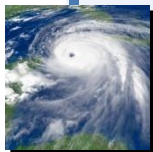
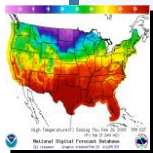
©2010 - Shannon Lupton



They look wider than the distance from the ground to the main cloud base



Rope Tornado



Supercell

Main Features

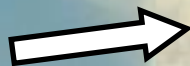
Overshooting Top



Anvil

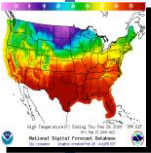


Rotating & Tilted
Updraft
(Meso-cyclone)

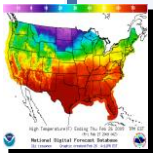
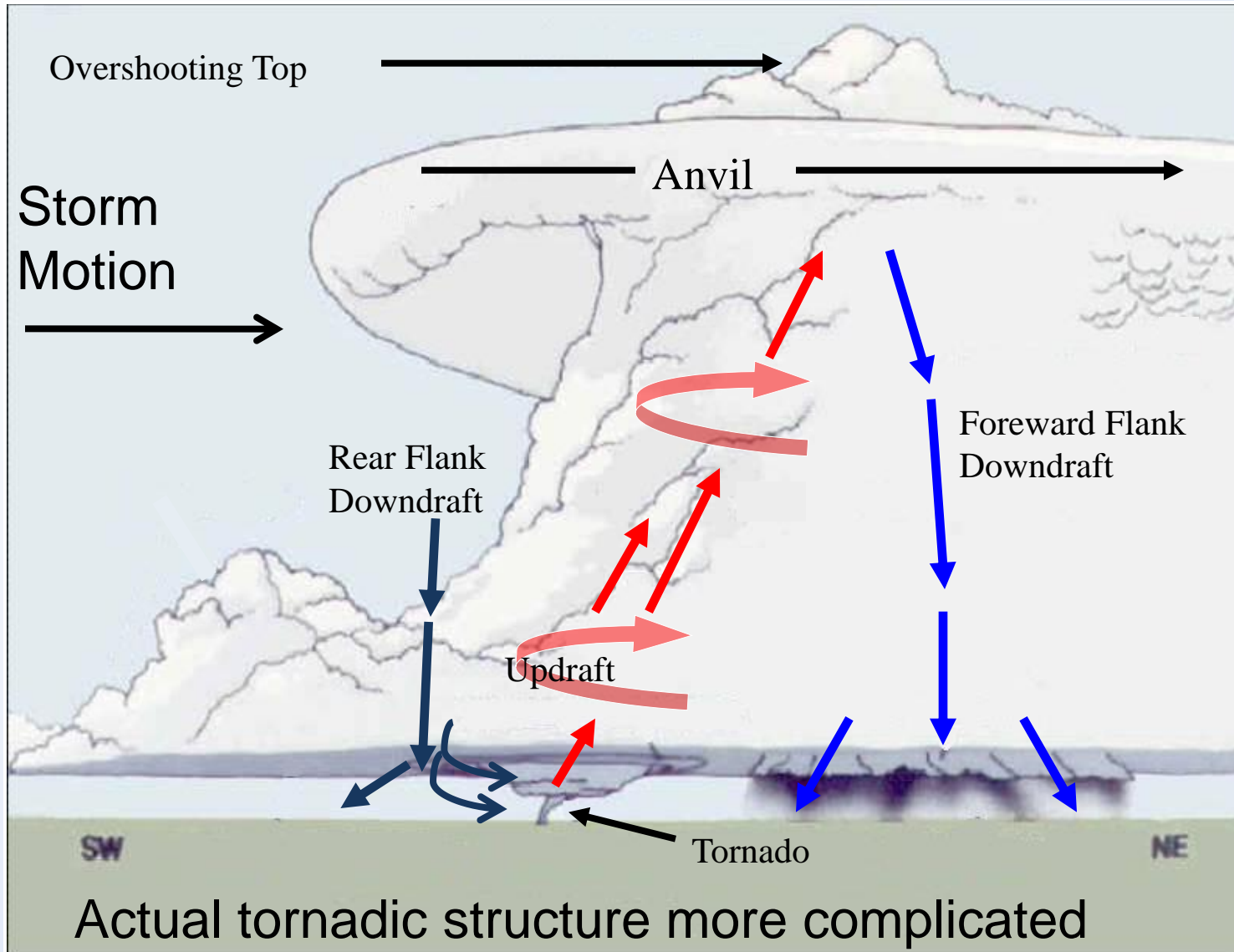


Supercell Thunderstorm

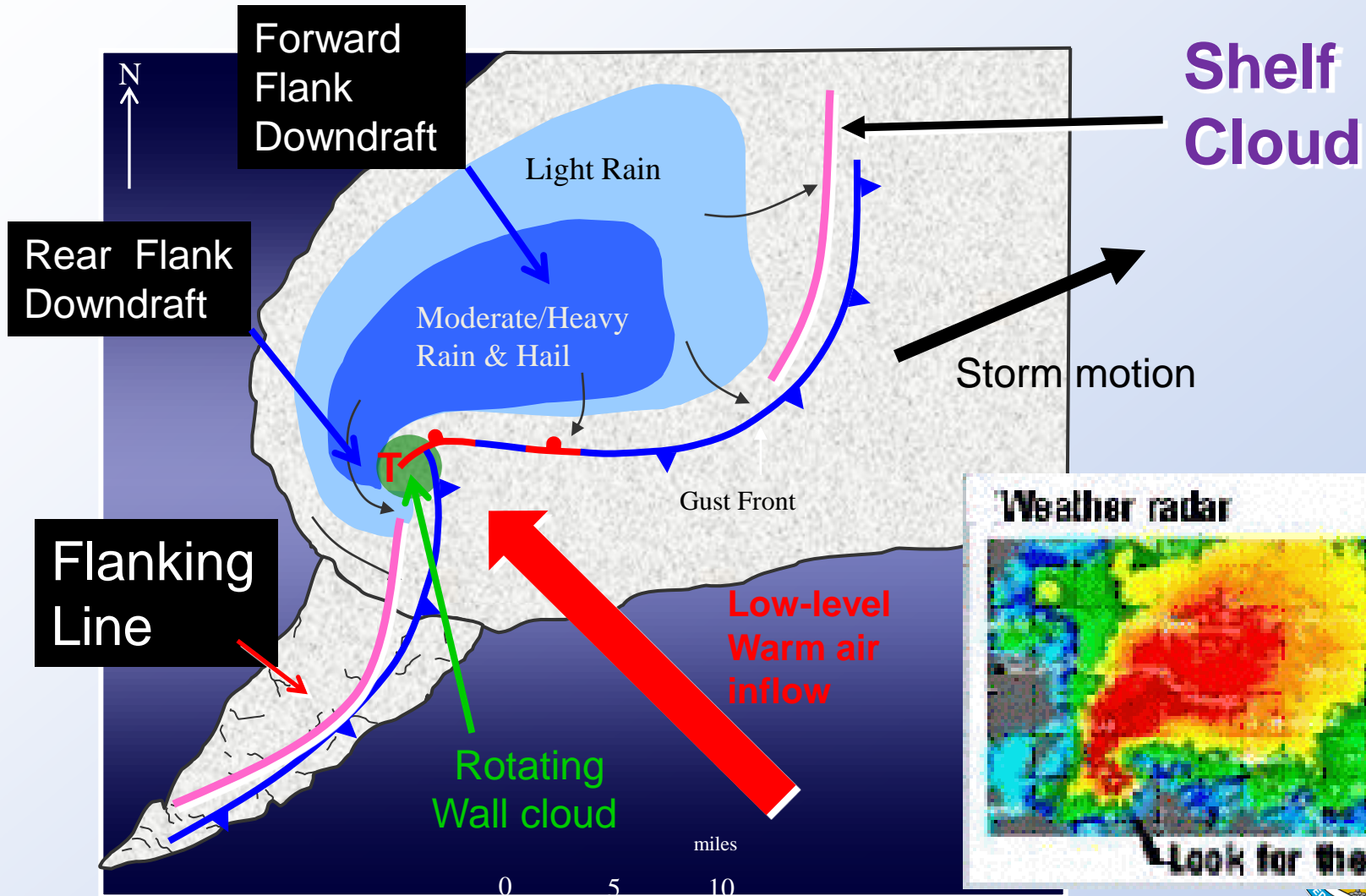
- S Contains a rotating updraft called a meso-cyclone
- S Only about 10-20% of radar-detected meso's are associated with a tornado
- S Produce large hail, high winds, and strong to violent tornadoes
- S Can last for several hours



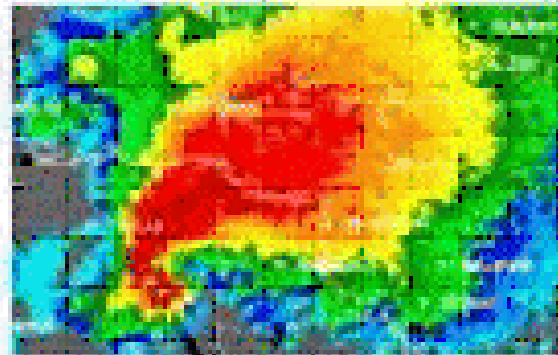
Tornadic Tstm Structure



Tornadic Supercell Thunderstorm



Weather radar



Look for the hook

Wall Cloud

Movement →

RFD

Wall Cloud

Beaver Tail

FFD

©2009 – Shannon Lupton

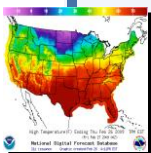
High-Resolution Weather Forecasting
National Digital Forecast Database



Supercell Features

National Weather Service

Protecting Lives and Property



Doug Raflik
July 27, 2009
Tornadic Supercell
Standing near Dalton,
but looking west-northwest
into southeast Marquette Co.

Rotating Updraft

Wet Microburst

RFD Shelf Cloud

Rotating Wall Cloud

Inflow band



Wall Cloud & RFD & FFD



What a difference a few minutes can make!



Storm Evolution

Mike Hollingshead
July 13, 2009
Kodoka SD to Valentine NE



©www.extremestability.com

Rotating
Wall Cloud



©www.extremestability.com



Storm Evolution

Mike Hollingshead
July 13, 2009
Kodoka SD to Valentine NE



RFD

Tornado



Storm Strength Clues

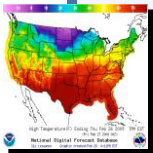
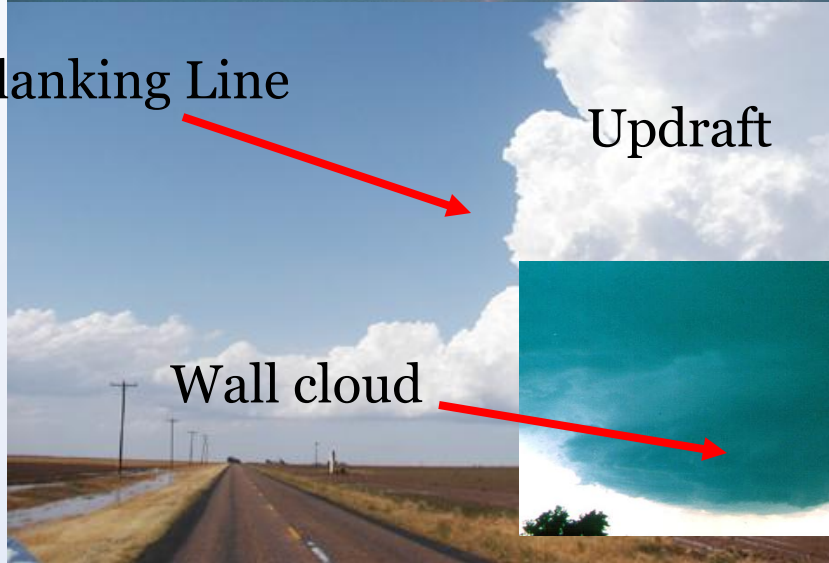


Overshooting Top

Flanking Line

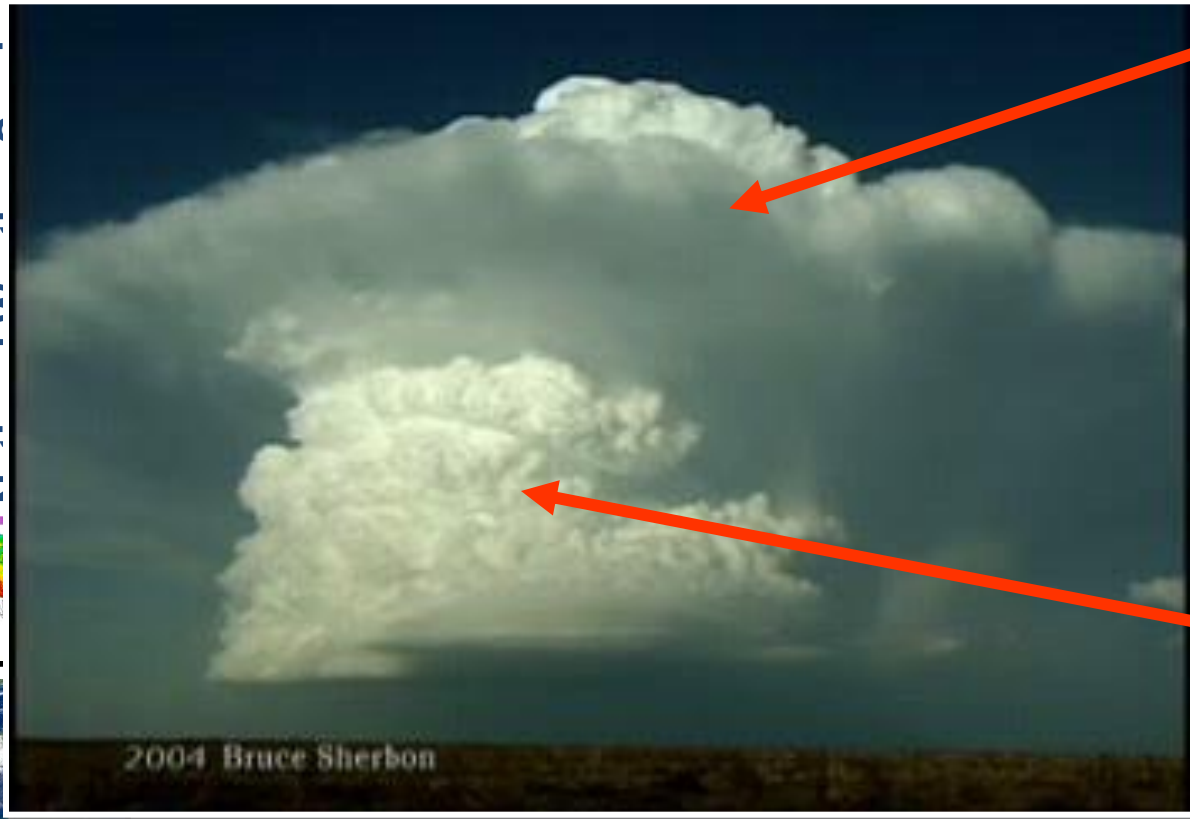
Updraft

Wall cloud



Evaluating the Surroundings

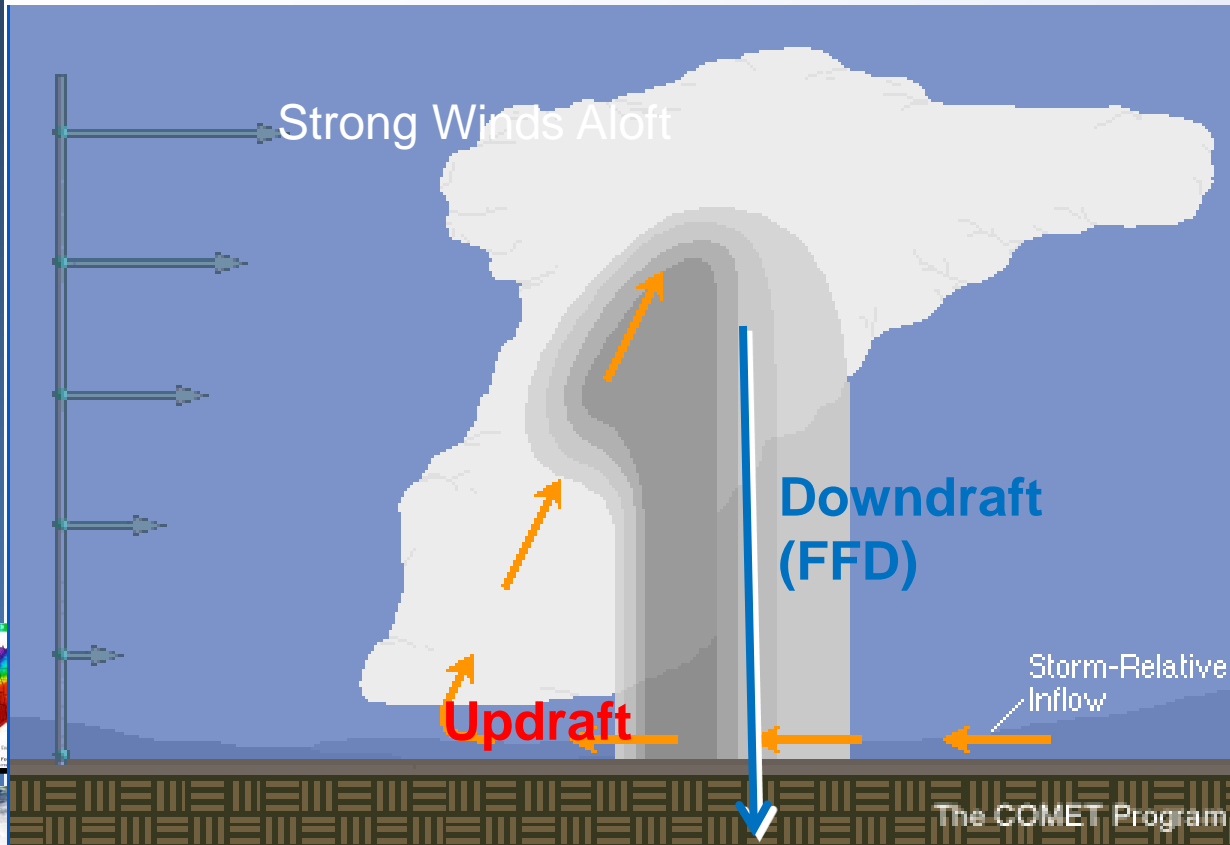
A thick, crisp anvil is another sign of a strong updraft



An indication of a rapidly, intensifying storm!



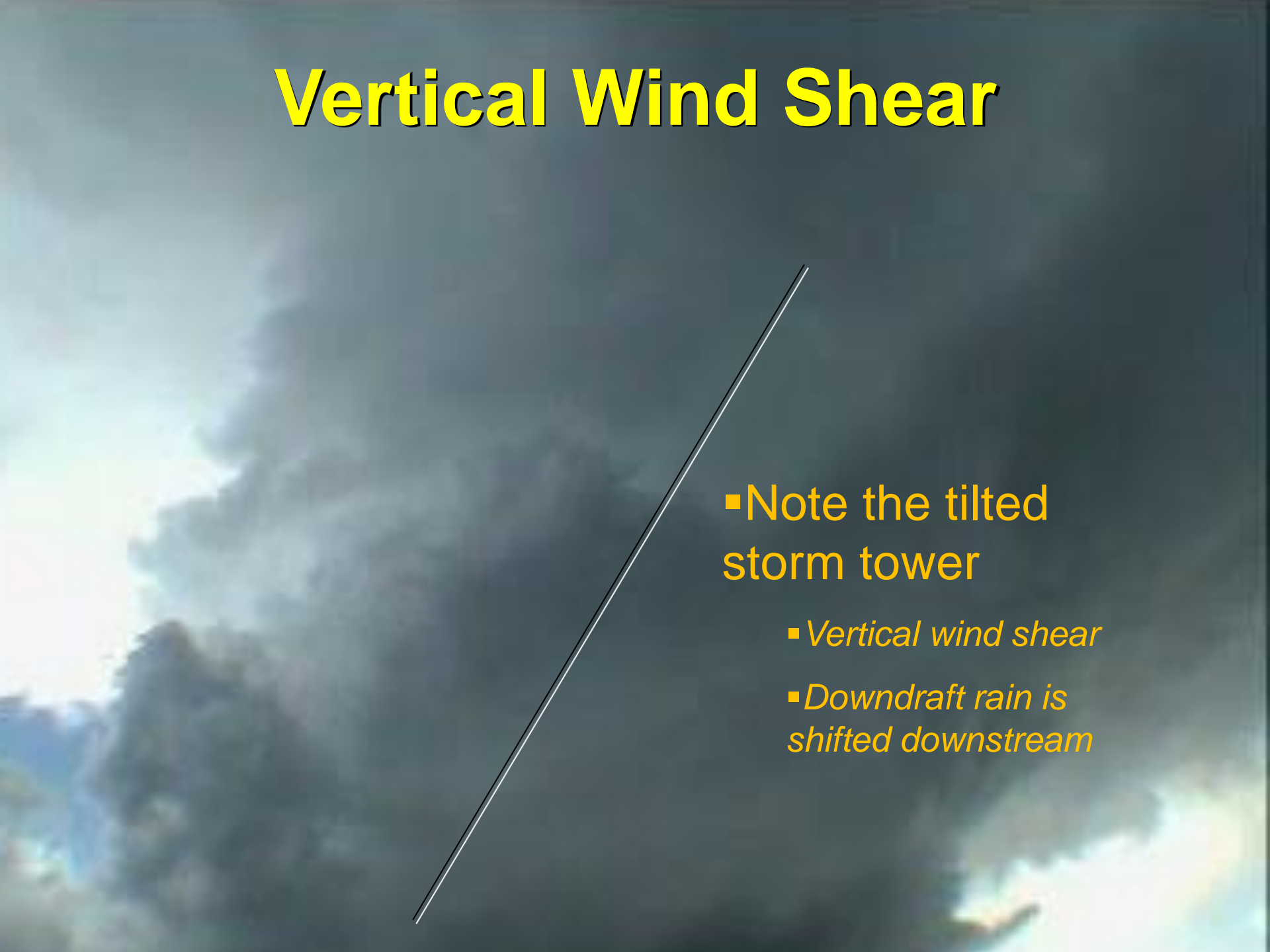
Updraft Tilt



Tilted updraft allows most of rain to fall downstream outside of updraft area.

Updraft isn't choked off by rain-cooled air and lives for more than an hour!

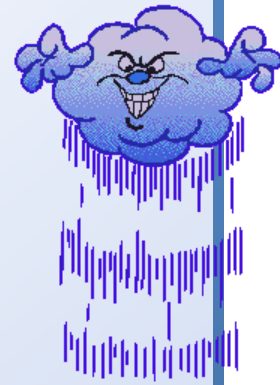
Vertical Wind Shear

A photograph of a dark, stormy sky with a bright light source on the left. A white line is drawn diagonally across the image, representing a tilted storm tower.

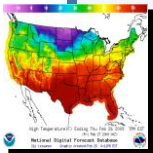
- Note the tilted storm tower

- *Vertical wind shear*
- *Downdraft rain is shifted downstream*

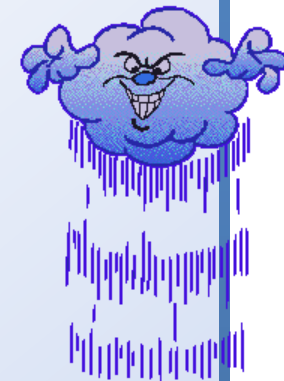
July 22, 2010



Albion storm after tornado ended
Dima Smirnov & Dan Henz
UW- Madison



July 22, 2010



Margaret Burlingham
Taken from 1.5 N Palmyra
Looking southeast
Rotating Wall Cloud - 1st storm
Storm moving right to left to
the east



Andrew Pritchard
July 22, 2010
Hwy 59 and N
NW of Milton
Rock County
Looking NE

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